

RangePRO Model ESLR-1020 Laser Rangefinder



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$$P_R = \frac{P_L \times \lambda \times \delta \times D_L \times A_1 \times \cos \beta}{4 \times R^2 \times A_L}$$



RangePRO Model ESLR-1020 Laser Rangefinder Module

1 DESCRIPTION

The RangePRO Model ESLR-1020 is an advanced laser rangefinding device enabling the accurate determination of range-to-target for ranges up to 12km for military, paramilitary and commercial applications. It is designed to operate as a stand-alone device but features processing, storage and communication capabilities to enable integration and operation with other sensors and systems.

The unit is controlled by buttons positioned where the fingers naturally fall when gripping the unit.

The ESLR-1020 is a digital laser rangefinder with multi-target capability incorporating 7 X 50 monocular viewing channel for visual target acquisition. The rangefinder employs an eye-safe laser source and the vision channel has dual use as the rangefinder's receiver channel.

An advanced Graphic User Interface (GUI) presents range and other data to the user via the eyepiece. The GUI employs a red-backlit LCD for display of data and features intensity adjustment. The graticule is part of this display as is a unique graphic representation of target range(s). The GUI is an advanced man-machine interface featuring a backlit LCD display superimposed on the field of view and a unique Target Bar presentation of range returns. The entire range-return waveform is stored and analysed enabling all valid targets to be portrayed in an at-a-glance manner. The GUI overlays an electronically generated graticule onto the field of view. To avoid display clutter, primary data only is displayed while secondary data and control information is accessed via simple menus.

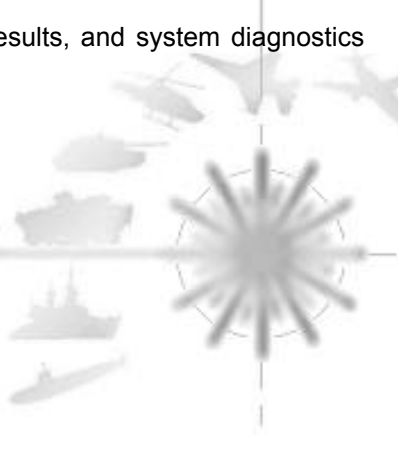
Housed in a rugged, sealed and shielded enclosure, the ESLR-1020 features rubber padding for protection and comfort, and a lens cap to protect the receiver/vision aperture.

The system consists of a laser transmitter, a receiver system for the detection of returned (reflected) laser signals, a viewing system, a display system for the display of data and a signal processor to provide range data from the returned signal. The transmitter is a collimated eye-safe laser system. It can provide ranging rates from single shot up to 12 per minute. The receiver system consists of a sensitive infra-red detector with an optics train to capture returned laser signals and direct them onto the detector. The viewing system shares part of its optics train with the receiver system to provide a 7X magnified view of the field of interest.

The signal processing system takes the returned laser signal captured by the receiver system and analyses it for relevant data. The ranges of up to five return signals are determined and the range of the largest return signal is first displayed. The user may access the other ranges by scrolling with the Scroll Up and Scroll Down buttons.

The display system utilises a LCD to overlay the aiming graticule, range, menu options and diagnostic data onto the field of view of the viewing system. The display unit is a micro liquid crystal display backlit with a high brightness red Light Emitting Diode (LED). The display gives a high degree of versatility for display customisation and is visible against all except bright red backgrounds. Its intensity is adjustable so that the optimum contrast ratio between the display and the incoming scene luminance may be set.

Graphical information about the operation/status of the rangefinder, range results, and system diagnostics (such as battery level, humidity and temperature) can be displayed.


$$P_R = \frac{P_L \times T^2 \times \delta \times D_L^2 \times A_t \times \cos \beta}{4 \times R^2 \times A_L}$$

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Advanced digital signal processing techniques are employed to provide accurate, reliable ranging. Signals from the detector are digitally sampled. The samples are examined to determine all potential real target returns which are then processed to accurately determine their ranges.

The system employs an adaptive range threshold to compensate for changing noise levels. The worst case for noise is when the system electronics are being operated at the high end of their temperature specification and when ranging is being performed in strong sunlight. The best case is the reverse situation. The adaptive range threshold feature results in more reliable ranging (fewer false alarms) when noise is elevated and higher sensitivity (further ranging) when noise is reduced, thus maximising the system capability under varying conditions. The threshold is calculated on a "shot-by-shot" basis.

The last 5 target solutions are stored in non-volatile (i.e. independent of power) memory. Recall is via a menu option and download via the Comms port. As a 6th solution is acquired, it is stored as Solution # 1 with the previous 4 solutions being renumbered and the old Solution #5 being erased. Thus the user may view or download the last (up to) 5 solutions at any time.

An external data interface is provided, via a standard MilSpec connector with a tethered sealing cap. It is factory-configurable to either RS-232 or RS-422 standard communications. The port is bi-directional but normally functions as "unidirectional", i.e. outputting a set string containing basic data. However, once connected to an appropriate external device, the system becomes fully interactive. The system design allows for integration with:

- most GPS systems (e.g. Rockwell PLGR+96 and PLGR II);
- digital goniometers (e.g. Leica SG-12F);
- Lasergyne's remote monitor units (Black Opal RMU Series); and
- compatible Thermal Imaging cameras (e.g. FLIR Systems MILCAM XP).

The interfacing and operational procedures are device-dependent and are factory-implemented to suit the device.

The ESLR-1020 performs comprehensive self-diagnostic functions on request, and displays the results via the LCD display. Users are quickly informed of the status of the device during field operations and maintenance personnel may obtain accurate feedback as to the system status minimising the need for long diagnostic sessions.

Other on-board facilities include:

- self-monitoring and diagnostic functions; and
- external interface capability.

The 3-point NATO mount plate option is a detachable adapter plate to suit the standard, quick-release, 3-point NATO mount configuration. It may be supplied with the ESLR-1020 or purchased and fit to the unit by the owner at any time.

RangePRO laser rangefinder software is easily upgradeable, upgrades can be downloaded in the field via a PC.


$$P_R = \frac{P_L \times X^2 \times \delta \times D_L^2 \times A_t \times \cos\beta}{4 \times R^2 \times A_L}$$

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2 SYSTEM SPECIFICATIONS

Notation - use of brackets in tables: [notes & qualifications] (units) {alternate units}.

2.1 System Performance

PARAMETER			SPECIFICATION	
Control				
Control Functions			On/Off/Standby; Charge; Fire; Mode; Scroll Up; Scroll Down	
Ranging				
Laser Type			Nd:YAG/OPO	
Wavelength (nm)			1,570	
Output Energy [per pulse] (mJ)			< 8 [typically 6.5]	
Beam Diameter [at exit] (mm)			18	
Beam Divergence [full angle; typical] (mrad)			560	
Receiver Aperture (mm)			50	
Detector			InGaAs with time variant gain	
Range Read-out		minimum	50	
Limits (m)		maximum	12,000	
Ranging Performance ¹ [max.] (m)	Std. Clear atmosphere	standard [1x1m]	8,100	
		vehicle [2.3x2.3m]	11,400	
	Modtran3 ²	building [8x8m]	12,000 [12km limit]	
		Std. Clear atmosphere	standard [1x1m]	6,900
	vehicle [2.3x2.3m]		9,300	
	RCA ³	building [8x8m]	12,000 [12km limit]	
Target Dis-crimination (m)	Lateral [1m ² targets @ 5,000m]		≤ 20	
	Axial [between 100 & 5,000m]		≤ 100	
Range Accuracy (m)			± 4 [4 rms]	
Ranging Rate [typical] (per minute)			12	
Range Return Delay [time to display; max.] (s)			< 5	

¹ Target albedo 0.53 @ 1,570nm.

² Extinction Coefficient 0.0448 @ 1,570nm (Modtran 3 V1.5; tropical atmosphere, maritime aerosols, Jan.).

³ Extinction Coefficient 0.097 @ 1,570nm (RCA Handbook).

$$P_R = \frac{P_L \times \epsilon^2 \times \delta \times D_L^2 \times A_t \times \cos\beta}{4 \times R^2 \times A_L}$$

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PARAMETER		SPECIFICATION
Safety & Protection		
Laser Classification [AS/NZS 2211.1: 1997]		Class 1
Nominal Hazard Distances for: (m)	eye [NOHD]	< 0
	skin [NSHD]	< 0
Maximum Safe Magnification for Assisted Viewing [full beam intercept]		17.8X
IR Filter [in viewing optics]		blocking
Filter OD [eye protection from in-service lasers]	@ 1,064nm	6.9
	@ 900 ±10nm	4.6
Protection of External Optical Surfaces		optical coating + lens cap
Electrical Protection	battery insertion	only polarity-correct insertion possible
	polarity labelling	polarity marked on battery cartridge
	internal battery charging	will not charge disposable batteries
Visible Emission [@ ³ 10m]		nil
Audible Emission [@ ³ 10m]		nil
Support		
MTBF (hours)		4,630
Reliability [72 hour mission] (%)		98.5
Operational Life (years)		15
Storage Life [90% probability full function] (years)		5
Operator Assistance		
Data Recall		last 5 solutions
Diagnostics [BITE]		overtemp., undertemp., over humidity, low battery

2.2 Sighting System

PARAMETER	SPECIFICATION
Type	Monocular
Magnification	7X
Field of View (mil {°})	> 110 {> 6.19}
Focus (m)	30 to ∞
Eye Relief (mm)	≥ 25
Exit Pupil Diameter [at 25mm eye relief] (mm)	≥ 7

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PARAMETER	SPECIFICATION
Diopetre Adjustment	-6 to +2
Image Distortion [across FoV] (%)	≤ 6
Eyeguard	rubber; removable
Optical Coating Compliance [eyepiece]	MIL-C-675C
Objective Lens Diameter (mm)	50 [integral with receiver aperture]
Twilight Factor	18.7
Recognition Range ⁴ (m)	≥ 3,450
System Resolution (lp/mrad)	≥ 6.1
Colour Fidelity	matches hues of target
Photopic Transmission (%)	≥ 80
Light Leakage [400 to 700nm] (%)	0

2.3 Display

PARAMETER	SPECIFICATION
General	
Display Type	backlit micro LCD
Presents to eyepiece	data & graticule
Data Display Duration	until next range operation or shut-down
Readability [ambient conditions; day against typical targets] (lux) night	10 to 10 ⁵ 0 to 10
Data Content	Charge/Ready-to-Fire; Range (largest return); Range target bar (multiple returns); Menu (recall solutions; diagnostics); Low battery warning
Data Display Format	
Ready-to-Fire	icon
Range [largest or selected return] style	alphanumeric
units	metres [yards optional]
Range [other returns] style	graphic ["target bar"] & alphanumeric
units	kilometres [by "target bar" scale]
Low Battery	icon

⁴ Vehicle target 2.3 x 2.3m; 10 to 10⁵ lux; 95% contrast; 70% probability.

$$P_R = \frac{P_L \times \tau^2 \times \delta \times D_L^2 \times A_t \times \cos \beta}{4 \times R^2 \times A_L}$$

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PARAMETER	SPECIFICATION
Graticule	
Graticule to Laser Alignment [radial angular subtense] (mil {°})	$\leq 0.1 \{5.63 \times 10^{-3}\}$
Pattern	custom
Apparent Line Width [at man recognition range] (m)	0.42
Parallax Error (mil {arcseconds})	0.1 {20}

2.4 Controls

#	Control Type	Location	Primary Label	Primary Function
1	Mode Button	Top of unit	M	Mode/Menu selection
2	Charge Button		C	Charge laser
3	Fire Button		F	Charge/Fire laser [take range]
4	Scroll Up Button		▲	Scroll up, left
5	Scroll Down Button		▼	Scroll down, right

2.5 Communications

PARAMETER	SPECIFICATION
Ports	2 serial ports
Type	RS-232 bi-directional
Data Format	8 bit; no parity
Data Rate [auto selected] (Baud)	1,200; 4,800; 9,600; 115.2k ⁵
Data Sent	range [diagnostics optional]

⁵ Baud rate of: 1,200 for Leica SG-12F with Leica Vector interface; 4,800 for Rockwell PLGR GPS interface; 9,600 for Leica SG-12F with ESLR-1000 interface, also for FLIR Milcam XP interface; 115.2k for maintenance operations with Laserdyne software.

$$P_R = \frac{P_L \times \epsilon^2 \times \delta \times D_L^2 \times A_t \times \cos \beta}{4 \times R^2 \times A_L}$$



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2.6 Physical Characteristics

PARAMETER		SPECIFICATION
Mass [with 1 set of batteries] (kg)		≤ 2.5
Dimensions (mm)	Length	< 220
	Width	< 210
	Height	< 100
Specific Gravity		< 0.85 [floatation]
Mounting		factory set 3-point mount for quick-change plate

2.7 Electrical Requirements

PARAMETER		SPECIFICATION
Integral Source [7.2Vdc nominal]	primary [disposable]	Lithium; AA cell; set of 6
	secondary (rechargeable)	NiCd; AA cell; set of 6
Integral Source Lifetime [@ 20°C] (hours {shots})	primary	≥ 4 {≥ 600}
	secondary	≥ 3 {≥ 300}
External Source	voltage range (Vdc)	10 to 32 [28 nominal]
	current drain [@28Vdc; max.] (A)	0.5

2.8 Environmental

PARAMETER			SPECIFICATION	
Temperature (°C)	Operate	min.	-19	
		max.	+44 [plus 1,120Wm ⁻² solar radiation]	
	Survive	min.	-21	
		max.	+70	
Vibration and Shock ⁶			Mil-STD-810E, wheeled vehicle	
Sealing ⁷			immersion proof	
EMI/EMC ^{6, 7}			MIL-STD-461D	
Resistance to Contaminants			ARMY(AUST) 6861, para. 5.12.2	

⁶ Refer to manufacturer for details.

⁷ With compliant line connectors attached.

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2.9 Connector/Pin Details

PARAMETER		SPECIFICATION
Connector A: Comms Port Connection: Connector, MilSpec, Panel, Plug, Bayonet, 4 Way, 700V, 5A, MS3112E8-4P		
Purpose		RS-232 Comms
Pins	A	common
	B	Rx
	C	Tx
	D	not used
Connector B: External dc Power [secondary Comms] Connection: Connector, MilSpec, Panel, Socket, Bayonet, 4 Way, 700V, 5A, MS3112E8-4S		
Purpose		external power [secondary Comms]
Pins	A	common
	B	Rx
	C	Tx
	D	external dc power

$$P_R = \frac{P_L \times \lambda^2 \times \delta \times D_L^2 \times A_t \times \cos\beta}{4 \times R^2 \times A_L}$$



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3 SET-UP

3.1 Mounts

The RangePRO has three mounting points, being M4 threaded holes located on the base of the unit. These are configured to accept the quick-release 3-point NATO mount plate option. Once fitted with this option the unit may be fitted to a compatible quick-change mount in one operation.

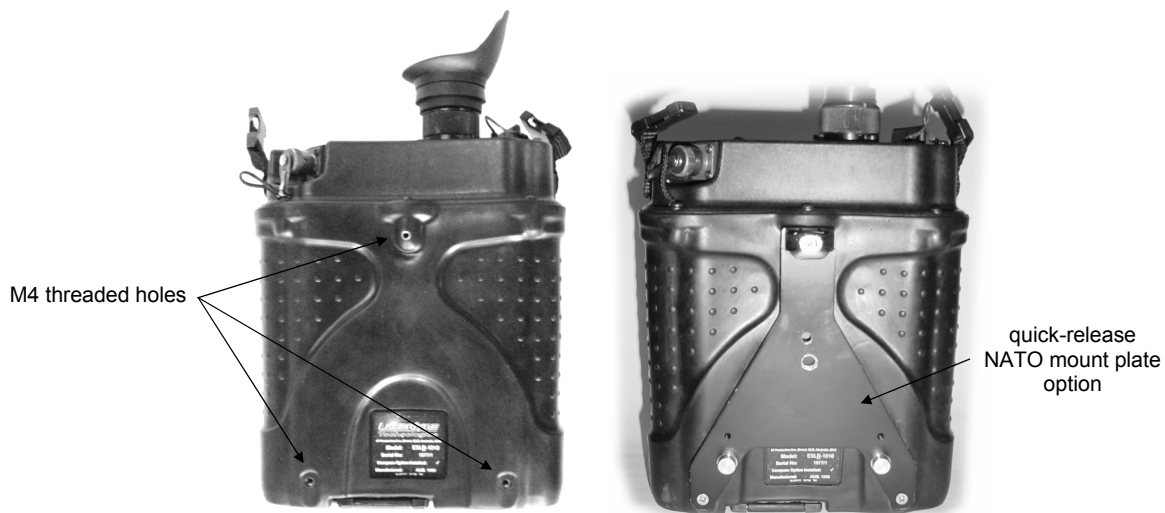


Figure 3-1: Mounts

3.2 Connections

CAUTION: do not connect or disconnect when external power is applied;
user-supplied connections must be correctly wired (see Connector/Pin Details).

The ESLR-1020 has two connection points, being 4-pin bayonet-lock MilSpec panel connectors, one on the top of the rear end of the unit (comms connection) the other on the left at the rear end of the unit (external power connection). Refer to specifications for connection details.

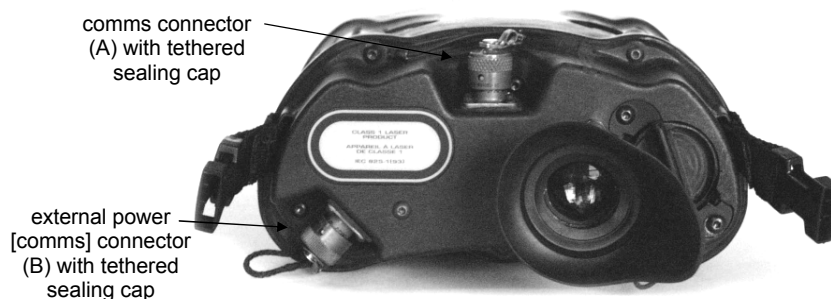


Figure 3-2: Connections

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4 OUTLINE DRAWINGS

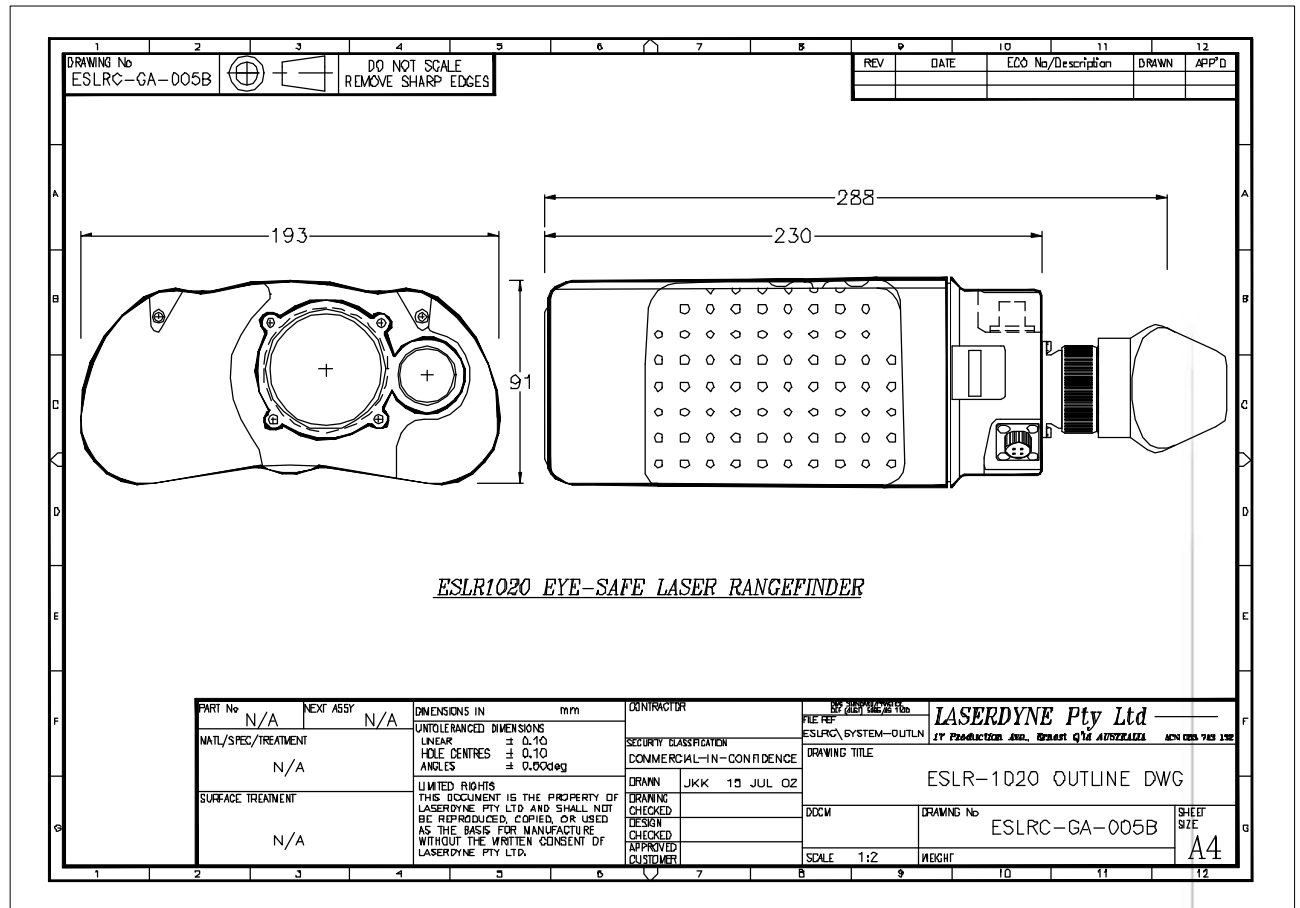


Figure 4-1: Outline Drawing

$$P_R = \frac{P_L \times X^2 \times \delta \times D_L^2 \times A_i \times \cos \beta}{4 \times R^2 \times A_L}$$

1	2	3	4	5	6	7	8	9	10	11	12						
DRAWING No ESLRC-GA-006A				DO NOT SCALE REMOVE SHARP EDGES				REV		DATE		ECO No/Description		DRAWN		APP'D	
<u>ESLR-1020 EYE-SAFE LASER RANGEFINDER</u> <u>WITH NATO MOUNT PLATE</u>																	
PART No ESLR-1020		NEXT ASSY FINAL		DIMENSIONS IN mm				CONTRACTOR				885 ENTERPRISE DRIVE PT. COOK, NSW 2150 LASERDYNE Pty Ltd 17 Production Ave., Ararat VIC 3200 AUSTRALIA MCM 000 763 132					
MATERIAL SPEC/TREATMENT		N/A		UNTOLERANCED DIMENSIONS LINEAR ± 0.10 HOLE CENTRES ± 0.10 ANGLES $\pm 0.50 \text{ deg}$				SECURITY CLASSIFICATION COMMERCIAL - IN - CONFIDENCE				FILE NO ESLRC SYSTEM - OUTLINE 4 DRAWING TITLE ESLR-1020 OUTLINE DWG					
SURFACE TREATMENT		N/A		LIMITED RIGHTS: THIS DOCUMENT IS THE PROPERTY OF LASERDYNE PTY LTD AND SHALL NOT BE REPRODUCED, COPIED, OR USED AS THE BASIS FOR MANUFACTURE WITHOUT THE WRITTEN CONSENT OF LASERDYNE PTY LTD.				DRAWN JKK 3 MAR 02 DRAWING CHECKED DESIGN CHECKED APPROVED CUSTOMER				DCCM DRAWING No ESLRC-GA-006A SCALE 1:2 WEIGHT					
												SHEET SIZE A3					
1	2	3	4	5	6	7	8	9	10	11	12						

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Technologies

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$$P_R = \frac{P_L \times X^2 \times \delta \times D_L^2 \times A_L \times \cos \beta}{4 \times R^2 \times A_L}$$